

CLAIMS:

1. (currently amended) A catalyst element comprising:
a substrate;
a thermal barrier coating disposed over the substrate; and
a combustion catalyst disposed over the thermal barrier coating;
wherein the thermal barrier coating comprises a columnar grained structure comprising a plurality of primary columns each supporting a respective plurality of secondary branches such that the thermal barrier coating exhibits a specific surface area of at least 18 m²/g.
2. (original) The catalyst element of claim 1, further comprising a ceramic wash-coat disposed between the thermal barrier coating and the catalyst.

Claims 3-5 (cancelled).

6. (currently amended) The catalyst element of claim ~~5~~ 1, further comprising a plurality of tertiary branches supported on the plurality of secondary branches, and wherein the thermal barrier coating exhibits a specific surface area of 50-150 m²/g.

7. (currently amended) A catalytic combustor comprising:
a fuel-air mixing device for producing a fuel-air mixture;
a catalytic element disposed downstream of the fuel-air mixing device for receiving the fuel-air mixture, the catalytic element further comprising:
a substrate;
a columnar grained thermal barrier coating disposed on the substrate, the thermal barrier coating comprising a plurality of primary columns approximately 10 microns in diameter and 10 microns in height each supporting a plurality of cones approximately 1 micron in diameter and 1 micron in height, the thermal barrier coating exhibiting a specific surface area of between 50-150 m²/g; and
a combustion catalyst disposed on the thermal barrier coating for reacting the fuel-air mixture.
8. (original) The catalytic combustor of claim 7, further comprising a ceramic wash-coat disposed between the thermal barrier coating and the catalyst.

Claims 9-22 (cancelled).

23. (new) A catalyst element comprising:
a metal substrate;
a layer of ceramic material disposed on the substrate and comprising a thickness effective to insulate the metal substrate from a combustion environment temperature that exceeds an operating temperature limit of the metal substrate when the combustion environment temperature exists at a surface of the ceramic material opposed the metal substrate; and
wherein the ceramic material comprises a material that is active as a catalyst for a fuel-air mixture at the surface opposed the metal substrate so as to support combustion of the fuel-air mixture to produce the combustion environment temperature, so that the single layer of ceramic material functions both as a combustion catalyst and as a thermal barrier coating for protecting the underlying metal substrate.

24. (new) The catalyst element of claim 23, wherein the ceramic material comprises a columnar grained material comprising a plurality of primary columns supporting a respective plurality of secondary branches so that the ceramic material exhibits a specific surface area of at least $18 \text{ m}^2/\text{g}$.

25. (new) The catalyst element of claim 24, wherein the ceramic material comprises a plurality of tertiary branches supported by the secondary columns so that the ceramic material exhibits a specific surface area of $50\text{-}150 \text{ m}^2/\text{g}$.

26. (new) The catalyst element of claim 23, wherein the ceramic material comprises one of the group of pyrochlores with the formula $\text{A}_2\text{B}_2\text{O}_7$ or AB_2O_6 where A is selected from the rare earth elements and B is selected from the group of zirconium, hafnium, titanium, niobium and tantalum.

27. (new) The catalyst element of claim 23, wherein the ceramic material comprises one of the group of perovskites with the formula ABO_3 where A is selected from the group of rare earth elements, alkaline earth elements and manganese, and B is selected from the group of aluminum, chrome, tungsten, zirconium, hafnium, titanium, niobium, tantalum, iron, manganese, cobalt, nickel and chrome.

28. (new) The catalyst element of claim 23, wherein the ceramic material comprises one of the group of garnets with the formula $\text{A}_3\text{Al}_5\text{O}_{12}$ where A is selected from the group of rare earth elements.

29. (new) The catalyst element of claim 23, wherein the ceramic material comprises one of the group of hexaluminates with the formula $\text{LaAl}_{11}\text{O}_{18}$, $\text{BaMnAl}_{11}\text{O}_{18}$, $\text{BaAl}_{12}\text{O}_{19}$, and $\text{BaMAl}_{11}\text{O}_{19}$ where M is selected from the group of chrome, manganese, iron, cobalt and nickel.

30. (new) The catalyst element of claim 23, wherein the ceramic material comprises one of the group of spinels with the formula AB_2O_4 where A is selected from the group of alkaline earth elements and B is selected from the group of aluminum, iron, manganese, cobalt, chrome and nickel.